



भौतिकी संस्थान
भुवनेश्वर
Institute of Physics

Bhubaneswar - 751005, India

(परमाणु ऊर्जा विभाग, भारत सरकार का एक स्वायत्त अनुसंधान संस्थान)
(An autonomous research institution of Dept. of Atomic Energy, Govt. of India)

संख्या No. 1832 /IP,

दिनांक Dated: 23/03/2020

The list of collaborative activities with other institutions/ research establishment/industry for research and academic development of faculty and students per year during the last five years in respect of Institute of Physics, Bhubaneswar, a Constituent Institution/ Off Campus Centre of HBNI is enclosed herewith.

(आर. के. रथ R. K. Rath)
रजिस्ट्रार REGISTRAR

रजिस्ट्रार/REGISTRAR
भौतिकी संस्थान/INSTITUTE OF PHYSICS
भुवनेश्वर/BHUBANESWAR

संलग्नक Encl: यथोपरि As above

सेवामें To,

श्रीमति भारती सुवर्णा Smt. Bharati Suvarna
सहायक कुलसचिव Assistant Registrar,
एचबीएनआई, मुंबई HBNI, Mumbai.


डा. घ.- सैनिक स्कूल, भुवनेश्वर - 751 005, भारत
P.O.: SAINIK SCHOOL, BHUBANESWAR - 751 005, INDIA

दूरभाष/Phone : 0674-2300637, 2301058, 2301823, फैक्स/Fax : 0674-2300142, वेब/Web : <http://www.iopb.res.in>

हमेशा हिंदी में पत्र व्यवहार करके देश का गौरव बढ़ाएं

3.7.1 Collaborative Activities

| Sl. No. | Title of the collaborative activity | Name of the collaborating agency with contact details | Name of the participant | Year of collaboration | Duration | Nature of the activity | Link to the relevant document |
|---------|---|---|--|-----------------------|--|---|---|
| 1 | Maxplank partner group with Max Plank group for solid state Research | Max-Planck Institute, Germany | Debakanta Samal | 2016 | 3 Years | Research | Award copy aatched |
| 2 | Entropic and active forces on confined polymers: Organization and dynamics of bacterial chromosomes | SCIENCE & ENGINEERING RESEARCH BOARD (SERB) 5 & 5A, Lower Ground Floor Vasant Square Mall Plot No. A, Community Centre Sector-B, Pocket-S, Vasant Kunj New Delhi-110070 | Debashish Chaudhuri | 2017 | 3 Years | Research | Award copy aatched |
| 3 | Participation in CMS experiment at LHC | CMS Collaboration, CERN, Geneva, Switzerland | Dr. Aruna Kumar Nayak and Students | 2016 – till date | Visits made during 23/09/2017 to 15/10/2017 21/09/2019 to 05/10/2019 | Physics analysis, trigger development, detector R&D in CMS experiment | Invitation letter 1 Invitation letter 2 |
| 4 | Higgs boson studies using CMS data | CMS Group, DESY, Notkestrasse-85, D-22607, Hamburg Germany | Dr. Aruna Kumar Nayak | 2016 | 15/06/2016 to 30/07/2016. | Physics analysis for the measurement of Higgs boson properties | Invitation letter |
| 5 | Higgs boson studies using CMS data | CMS Group, DESY, Notkestrasse-85, D-22607, Hamburg Germany | Mr. Vinaya Krishna Nair & Mr. Diwakar Vats (PhD Students) | 2018 & 2019 | 15/10/2018 to 14/11/2018 and 15/09/2019 to 14/10/2019 | Physics analysis for the measurement of Higgs boson properties | Invitation letter 1 Invitation letter 2 Invitation letter 3 Invitation letter 4 |
| 6 | Higgs boson studies using CMS data | CMS Group, DESY, Notkestrasse-85, D-22607, Hamburg Germany | Dr. Aruna Kumar Nayak | 2019 | 05/10/2019 to 12/10/2019 | Physics analysis for the measurement of Higgs boson properties | Invitation letter |
| 7 | ALICE collaboration at LHC | CERN CH 1211 Geneva 23 Switzerland Building 301/R-029 alice.secretariat@cern.ch Tel : 62525 | Prof. P. K. Sahu, Er. Sanjib Sahu, Ms. Sarita Sahoo and Ms. Sagarika Swain | 2006 | Till Continuing | Data taking & Data Analysis, Detector Fabrication and Presentation | http://alice-collaboration.web.cern.ch/General/Members/List_Institutes.html |
| 8 | STAR Collaboration at RHIC | STAR experiment at BNL, Newyork, USA | Prof. P. K. Sahu and Mr. S. Tripathy | 2010 | Till Continuing | Data taking & Data Analysis, Detector Fabrication and Presentation | https://fair-center.eu/for-users/experiments/cbm-and-hades/cbm/collaboration.html |
| 9 | CBM Collaboration at FAIR | FAIR - Facility for Antiproton and Ion Research in Europe GmbH Planckstr. 1 64291 Darmstadt GERMANY | Prof. P. K. Sahu, Er. Sanjib Sahu and Dr. B. Mallick | 2011 | Till Continuing | Detector Fabrication & testing and Presentation | https://fair-center.eu/for-users/experiments/cbm-and-hades/cbm/collaboration.html |
| 10 | High pure Alumina for solar cell anti-reflection coatings and reinforcing aluminium | NALCO, NALCO Corporate Office Bhavan, P-1, Nayapalli, Bhubaneswar-7510013 | Prof. P.V. Satyam | 2018 | Till Continuing | Research Collaboration | Order copy of proposal approval |
| 11 | Development of Aluminium-based material for energy storage application - Supercapacitor | NALCO, NALCO Corporate Office Bhavan, P-1, Nayapalli, Bhubaneswar-7510013 | Prof. P.V. Satyam | 2018 | Till Continuing | Research Collaboration | Order copy of proposal approval |


 राजस्टर/REGISTRAR
 भौतिकी संस्थान/INSTITUTE OF PHYSICS
 भुवनेश्वर/BHUBANESWAR



MAX-PLANCK-GESELLSCHAFT

THE PRESIDENT

Letter of Appointment

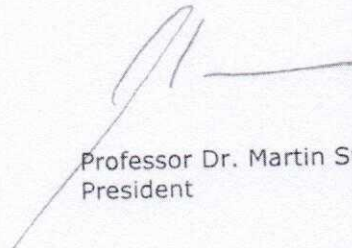
It is with great pleasure that I herewith appoint

Dr. Debakanta Samal

Head of the Partner Group of the Max Planck Institute for Solid State Research at the Institute of Physics in Bhubaneswar. The scientific work of Dr. Samal has already gained international recognition and Dr. Samal shall continue on this successful path as Head of the Max Planck Partner Group.

The Max Planck Society and especially the Max Planck Institute for Solid State Research will continually support Dr. Samal in developing the Max Planck Partner Group into an active research group of the Indian and international scientific communities.

Munich, December 2016



Professor Dr. Martin Stratmann
President

FILE NO. EMR/2016/001454

SCIENCE & ENGINEERING RESEARCH BOARD(SERB)

(a statutory body of the Department of Science & Technology, government of India)

5 & 5A, Lower Ground Floor
Vasant Square Mall
Plot No. A, Community Centre
Sector-B, Pocket-5, Vasant Kunj
New Delhi-110070

Dated: 15-Mar-2017

ORDER

Subject: Financial Sanction of the research project titled "**Entropic and active forces on confined polymers: Organization and dynamics of bacterial chromosomes**" under the guidance of Dr. Debasish Chaudhuri, Physics, Institute of Physics, Sachivalaya marg, bhubaneswar, Bhubaneswar, Odisha-751005 - Release of 1st grant.

Sanction of **Science and Engineering Research Board (SERB)** is hereby accorded to the above mentioned project at a total cost of **Rs. 2944836/-** (Rs. Twenty Nine Lakh Forty Four Thousand Eight Hundred and Thirty Six **Only**) with break-up of **Rs. 1200000/-** under **Capital (Non-recurring) head** and **Rs.1744836/-** under **General (Recurring) head** for a duration of Three years. The items of expenditure for which the total allocation of **Rs. 2944836/-** has been approved are given below: The following budget may be considered for **Institute Of Physics, Sachivalaya Marg, Bhubaneswar**

| S. No | Head | Total (in Rs.) |
|-----------|---|----------------|
| A | Non-recurring | |
| 1 | Equipment -> Printer -> UltraSharp Multimedia Monitor and keyboard and mouse -> Computer Cluster | 1200000 |
| A' | Total (Non-Recurring) | 1200000 |
| B | Recurring Items | |
| 1 | Recurring - A : (Manpower, Consumables, Travel, Contingencies) | 1526700 |
| 2 | Recurring - B : (Overhead Charges) | 218136 |
| B' | Total (Recurring) | 1744836 |
| C | Total cost of the project (A' + B') | 2944836 |

- Sanction of the **SERB** is also accorded to the payment of
• **Rs. 1200000/-** (Rupees Twelve Lakh only) under 'Grants for creation of capital assets' to **Director, Institute Of Physics, Sachivalaya Marg, Bhubaneswar** being the first installment of the grant for the year 2016-2017 for implementation of the said research project.
- The expenditure involved is debitable to **Fund for Science & Engineering Research (FSER)** **This release is being made under Extra Mural Research Funding (Individual Centric). (PAC Physical Sciences)**
- The Sanction has been issued to Institute Of Physics, Sachivalaya Marg, Bhubaneswar with the approval of the competent authority under delegated powers on **14 March, 2017** and vide Diary No. **SERB/F/9439/2016-17** dated **15 March, 2017**
- Sanction of the grant is subject to the conditions as detailed in Terms & Conditions available at website (www.serb.gov.in).
- Overhead expenses are meant for the host Institute towards the cost for providing infrastructural facilities and general administrative support etc. including benefits to the staff employed in the project.

7. While providing operational flexibility among various subheads under head Recurring-A, it should be ensured that not more than Rs. 1.5 lakh each should be spent for travel and contingency.

8. As per rule 211 of GFR, the accounts of project shall be open to inspection by sanctioning authority/audit whenever the institute is called upon to do so.

9. The sanctioned equipment would be procured as per GFR and its disposal of the same would be done with prior approval of SERB.

10. The release amount of Rs. 1200000/- (Rupees Twelve Lakh only) will be drawn by the Finance & Budget Officer of the SERB and will be disbursed by means of RTGS transaction as per their Bank details given below:

| | |
|------------------------|---|
| Account Name | Institute of Physics |
| Account Number | 147601000010917 |
| Bank Name & Branch | Indian Overseas Bank Chandrasekharpur Branch, Indian Overseas Bank, Chandrasekharpur Branch, Post Office - Sainik School, Bhubaneswar, PIN - 751005 |
| IFSC/RTGS Code | IOBA0001476 |
| Email id of A/C Holder | director@iopb.res.in |
| Email id of PI | debc@iopb.res.in |

11. The institute will furnish to the SERB, New Delhi, separate Utilization certificate(UCs) financial year wise to the SERB for Recurring (Grants-in-aid General) & Non-Recurring (Grants for creation of capital assets) and an audited statement of accounts pertaining to the grant immediately after the end of each financial year.

12. The institute will maintain separate audited accounts for the project. A part or whole of the grant must be kept in an interest earning bank account which is to be reported to SERB. The interest thus earned will be treated as credit to the institute to be adjusted towards further installment of the grant.

13. The project File no. EMR/2016/001454 may also be mentioned in all research communications arising from the above project with due acknowledgement of SERB.

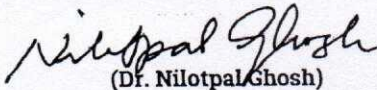
14. The manpower sanctioned in the project, if any is co-terminus with the duration of the project and SERB will have no liability to meet the fellowship and salary of supporting staff if any beyond the duration of the project

15. As this is the first grant being released for the project, no previous U/C is required.

16. The institute may refund any unspent balance to SERB by means of a Demand Draft favoring "FUND FOR SCIENCE AND ENGINEERING RESEARCH" payable at New Delhi.

17. The organization/institute/university should ensure that the technical support/financial assistance provided to them by the Science & Engineering Research Board, a statutory body of the Department of Science & Technology (DST), Government of India should invariably be highlighted/ acknowledged in their media releases as well as in bold letters in the opening paragraphs of their Annual Report.

18. In addition, the investigator/host institute must also acknowledge the support provided to them in all publications, patents and any other output emanating out of the project/program funded by the Science & Engineering Research Board, a statutory body of Department of Science & Technology (DST), Government of India.

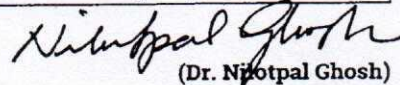

(Dr. Nilotpal Ghosh)
MS

nilotpal@serb.gov.in

To,
Finance & Budget Officer
SERB, New Delhi

Copy forwarded for information and necessary action to: -

| | |
|----|--|
| 1. | The Principal Director of Audit, A.G.C.R. Building, IIIrd Floor I.P. Estate, Delhi-110002 |
| 2. | Sanction Folder, SERB, New Delhi. |
| 3. | File Copy |
| 4. | Dr. Debasish Chaudhuri Physics Institute of Physics, Sachivalaya marg, bhubaneswar, Bhubaneswar, Odisha-751005 Email: debc@iopb.res.in Mobile: 919553594032 (Start date of the project may be intimated by name to the undersigned. For guidance, terms & Conditions etc. Please visit www.serb.gov.in .) |
| 5. | Director, Institute Of Physics, Sachivalaya Marg, Bhubaneswar (Receipt of Grant may be intimated by name to the undersigned) |



(Dr. Nilotpal Ghosh)

MS

nilotpal@serb.gov.in



DESY, VGS / IO, 22603 Hamburg

Prof. Sudhakar Panda
Institute of Physics
Sachivalaya Marg, PO – Sainik School
Bhubaneswar 751005, Odisha
India

International Office

Anna Kazakova
Tel. +49 40 8998-4637
Fax +49 40 8998-4449
international.office@desy.de

April 20, 2016

Invitation to DESY for Dr. Aruna Kumar Nayak

Dear Professor Panda,

DESY would like to ask you to send the scientist Dr. Aruna Kumar Nayak to do **research in the CMS group from June 15 until July 30, 2016.**

During Dr. Nayak's stay in Hamburg his living expenses will be covered by DESY. DESY will reimburse the travel costs, up to a maximum of €1,000. Detailed information can be obtained from the International Office or the group secretaries.

DESY requires that Dr. Nayak takes out adequate medical insurance for the period of his stay. In addition, Dr. Nayak should have liability insurance, which is available at DESY International Office.

Please ask Dr. Nayak to inform the group of his arrival date. For accommodation arrangements, Dr. Nayak should fill out the Housing Request Form at <http://guest-services.desy.de> → 'Housing' as soon as possible.

German law requires Dr. Nayak to have a valid visa. Enclosed you will find a document for presentation with the visa application at the German embassy or consulate.

With best regards,

A. Kazakova
Anna Kazakova
International Office



DESY Deutsches
Elektronen-Synchrotron
Notkestraße 85
Hamburg
Tel. +49 40 8998-0
Fax +49 40 8998-3282

Postal address
22603 Hamburg

Locations of DESY
Hamburg
Zeuthen/Brandenburg

Directorate
Dr. R. Brinkmann
Prof. Dr. H. Dösch
(Chairman)
Prof. Dr. J. Mnich
C. Haringa
Prof. Dr. E. Weckert
Prof. Dr. C. Stegmann
(Representative of Directors
in Zeuthen)



EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
COMPACT MUON SOLENOID COLLABORATION

URL : <https://cms.cern/>



Adresse postale / Mailing address*:

Mrs Tania PARDO
Supervisor of CMS Secretariat
CERN – EP Department
CH - 1211 GENEVA 23

Tel. +41 22 767 8511
Fax +41 22 766 7566
E-mail Tania.Pardo@cern.ch

Dr. Aruna Kumar NAYAK
Institute of Physics, Sachivalaya Marg,
PO - Sainik School, Bhubaneswar -
751005, Odisha, INDIA.

Geneva, 22 August 2017

Notre référence / Our reference : CMS-22/08/2017/TP/JPL

Dear Dr. NAYAK,

We are pleased to invite you to CERN to take part in activities related to the CMS Collaboration as an associated member of the personnel from 15 September 2017 until 15 October 2017.

It is incumbent upon your home institute to make sure that you have the necessary financial means, throughout the duration of your association with the Organization, to cover your stay in the local area as well as that of any accompanying family members.

In accordance with the CERN Staff Rules and Regulations, your social insurance cover is the responsibility of your home institute and, by default, yourself. It must comprise health insurance covering the financial consequences of professional and non-professional illness and accidents at levels adequate in France and Switzerland.

Any members of the family accompanying you must also have health insurance covering the financial consequences of illness and accidents at levels adequate in both France and Switzerland.

For further information, please read <http://usersoffice.web.cern.ch/health-insurance-information>.

Given that the Organization is located astride the border between France and Switzerland, we strongly recommend you contact the relevant consulates for information on the entry conditions applicable to you in these two countries, specifying the **duration** and **nature** of your work at CERN. Where appropriate, as soon as you receive this letter, please take the necessary steps to obtain **before you depart** the requisite documents, in particular a visa for **multiple entries to the Schengen member countries**:

- **either by going to the French Consulate competent for your usual place of residence**, presenting the enclosed Convention d'accueil, **duly signed by you**, and explaining that you will become a member of the CERN personnel entitled to freedom of access to, and residence on, French territory (without visa charges and without delay) under Article XI § 2 of the Status Agreement between CERN and France dated 13 September 1965, as revised on 16 June 1972;

- **or by going to the Swiss Consulate competent for your usual place of residence, taking this letter with you**, explaining that you will become a member of the CERN personnel

*Adresse postale pour le courrier posté en France : CERN : Site de Prévessin, F-01631 CERN Cedex

entitled to freedom of access to, and residence on, Swiss territory under Article 12 of the Status Agreement between CERN and Switzerland dated 11 June 1955.

We wish you an excellent stay at CERN.

Yours sincerely,

Tania Pardo





DESY. | V1 / IO, 22603 Hamburg

Prof. Sudhakar Panda
Institute of Physics
Sachivalaya Marg, PO – Sainik School
Bhubaneswar – 751005,
Odisha,
India

Gabriella Kirstein
international.office@desy.de

International Office
Notkestraße 85
22607 Hamburg
Phone +49 40 8998-3440
Fax +49 40 8998-4449

26. September 2018

Invitation to DESY for Mr. Diwakar

Dear Professor Panda,

DESY would like to ask you to send the student Mr. Diwakar to do research in the CMS group for 16 days in the period from October 15 until November 14, 2018.

During Mr. Diwakar's stay in Hamburg his living expenses will be covered by DESY. DESY will reimburse the cheapest available travel ticket (economy class). Detailed information can be obtained from the International Office or the group secretaries.

DESY requires that Mr. Diwakar takes out adequate medical insurance for the period of his stay. In addition, Mr. Diwakar must have liability insurance, which is available at DESY International Office.

Please ask Mr. Diwakar to inform the group of his arrival date. For accommodation arrangements, Mr. Diwakar should fill out the Hostel Request Form at <http://welcome-services.desy.de> → 'Hostel' as soon as possible.

German law requires Mr. Diwakar to have a valid visa. Enclosed you will find a document for presentation with the visa application at the German embassy or consulate.

With best regards,


Gabriella Kirstein
DESY International Office



DESY. Deutsches
Elektronen-Synchrotron
Notkestraße 85
22607 Hamburg
Germany
www.desy.de

Location Zeuthen
Platanenallee 6
15738 Zeuthen
Germany

Directorate
Dr. R. Brinkmann
Prof. Dr. H. Dosch
(Chairman)
C. Haringa
(Deputy Chairman)
Prof. Dr. J. Mnich
Prof. Dr. C. Stegmann
(Representative of
Directorate in Zeuthen)
Prof. Dr. E. Weckert



DESY | V1 / IO, 22603 Hamburg

Prof. Sudhakar Panda
Institute of Physics
Sachivalaya Marg, PO – Sainik School
Bhubaneswar – 751005
Odisha
India

Gabriella Kirstein
international.office@desy.de

International Office
Notkestraße 85
22607 Hamburg
Phone +49 40 8998-3440
Fax +49 40 8998-4449

26. September 2018

Invitation to DESY for Mr. Vinaya Krishnan Muraleedharan Nair Bindhu

Dear Professor Panda,

DESY would like to ask you to send the student Mr. Vinaya Krishnan Muraleedharan Nair Bindhu to do research in the CMS group for 16 days in the period from October 15 until November 14, 2018.

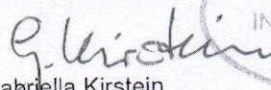
During Mr. Muraleedharan Nair Bindhu's stay in Hamburg his living expenses will be covered by DESY. DESY will reimburse the cheapest available travel ticket (economy class). Detailed information can be obtained from the International Office or the group secretaries.

DESY requires that Mr. Muraleedharan Nair Bindhu takes out adequate medical insurance for the period of his stay. In addition, Mr. Muraleedharan Nair Bindhu must have liability insurance, which is available at DESY International Office.

Please ask Mr. Muraleedharan Nair Bindhu to inform the group of his arrival date. For accommodation arrangements, Mr. Muraleedharan Nair Bindhu should fill out the Hostel Request Form at <http://welcome-services.desy.de> → 'Hostel' as soon as possible.

German law requires Mr. Muraleedharan Nair Bindhu to have a valid visa. Enclosed you will find a document for presentation with the visa application at the German embassy or consulate.

With best regards,


Gabriella Kirstein
DESY International Office



DESY, Deutsches
Elektronen-Synchrotron
Notkestraße 85
22607 Hamburg
Germany
www.desy.de

Location Zeuthen
Platanenallee 6
15738 Zeuthen
Germany

Directorate
Dr. R. Brinkmann
Prof. Dr. H. Dosch
(Chairman)
C. Haringa
(Deputy Chairman)
Prof. Dr. J. Mnich
Prof. Dr. C. Stegmann
(Representative of
Directorate in Zeuthen)
Prof. Dr. E. Weckert

WORK ORDER

Ref No: NBC/R&D/63/12/1206
Date: 14.09.2018

To,
The Director
CSIR - Institute of Minerals & Materials Technology,
Bhubaneswar-751013
Odisha, India

Kind Attention: Dr. Bikash Kumar Jena

Sub: Work Order on: "Development of Aluminum-based Materials for Energy Storage Application - Supercapacitor".

Ref: Your project proposal submitted against our Expression of Interest (EOI) NBC/R&D/643 Dated 21.09.2017.

Dear Sir,

With reference to the subject of Project Proposal submitted against our Expression of Interest (EOI), discussion with our Corp, Smelter & Refinery R&D team as well as presentation on 5th and 6th April 2018 and subsequent communication & clarifications; we are pleased to issue this work order in accordance with agreed terms and conditions as set out below.

The work order incorporating the complete technical specification, other terms & conditions, which also forms part of this work order, no variation of any nature shall be permitted to those conditions of this work order except with the prior written consent of NALCO.

Whereas Institute of Minerals & Materials Technology (herein after called IMMT), Bhubaneswar along with its collaborative agency Institute of Physics, Bhubaneswar & Indian Institute of Technology, Bhubaneswar have agreed for undertaking a Collaborative R&D Project on "Development of Aluminum-based Materials for Energy Storage Application - Supercapacitor". However, IMMT, Bhubaneswar shall be nodal agency and responsible for implementation of this project as per the terms and condition of this work order. All correspondences, including payments shall be done with IMMT, Bhubaneswar.

1. Project Title:

Development of Aluminium-based Materials for Energy Storage Application – Supercapacitor.

2. Objective:

The main objective of the proposal is to utilize Al based materials for energy storage applications towards the development of supercapacitors.

Head/R&D

नेशनल एल्युमिनियम कम्पनी लिमिटेड
(भारत सरकार का उद्यम)
निगम कार्यालय

National Aluminium Company Limited
(A Government of India Enterprise)
CORPORATE OFFICE

नालको भवन, नयापल्ली, भुवनेश्वर-751 061, भारत


NALCO BHAVAN, Nayapalli, Bhubaneswar-751 061, INDIA

फोन Phone: (EPABX) (0674) 2301988, 2301999, 2300013, 2300976, 2301550, 2303233

फैक्स Fax: (0674) 2301290, 2300580, 2300740, 2300640 & 2300246

वेबसाइट Website: www.nalcoindia.com

649
18/9/18


17/09

3. Scope:

The main constituent of supercapacitors i.e. current collector, electrolyte and active materials will be designed with the Al-based materials/compounds to enhance the capacitance retention properties for energy storage applications.

In general, supercapacitor devices consist of current collectors, electrode materials, and electrolyte.

- i. Aluminium foil and aluminium-graphene composite due to its excellent flexibility, high conductivity & good stability will be used as the current collector in this project.
- ii. In this project steps will be taken to develop trivalent Al^{+3} insertion ions to be used as electrolyte for supercapacitors instead of monovalent & divalent ions as the later exhibit instability, high-cost, and hard handling. Aluminium based electrolyte like $AlCl_3$, $Al_2(SO_4)_3$, $Al(NO_3)_3$ etc. showing good capacitive behavior for supercapacitor application will be designed in the project.
- iii. In this project Al will be used as electrode material. Normally, some transition metal hydroxides like $Ni(OH)_2/Co(OH)_2$ and their composite have been used as electrodes because of its abundance and high theoretical capacitance. However recycling performance of the electrodes is very poor. To overcome these drawbacks, bivalent metal cations are being partially replaced with trivalent metal ions to improve cycle life by the synergetic effect of complex metal ions.
- iv. Finally, the developed components shall be used to fabricate a coin-cell type supercapacitor.

4. Methodology

In order to achieve the above mentioned objective IMMT & its collaborative agencies will adopt the following methodology.

- i. Procurement of chemicals and arrangement of work set-ups
- ii. Development of materials and optimisation of process
- iii. Characterization of as-developed materials by various techniques and optimisation of the synthesis process
- iv. Studies on the supercapacitance properties and optimisation of the process to enhance the properties
- v. Design and development of coin cell type supercapacitor and optimisation of the process
- vi. Testing of the supercapacitance properties of the coin cell

5. Broad work plan of IMMT, IOP & IIT, Bhubaneswar.

Responsibility of IMMT, Bhubaneswar- Development of Al-based materials, electrolyte etc. and study on their energy storage properties and fabrication of supercapacitors.

Responsibility of IOP, Bhubaneswar- Characterization of as-developed Al-based materials by various techniques.

Responsibility of IIT, Bhubaneswar- Studies on the possible mechanism of the process and aluminium graphene composite optimization.

However IMMT, Bhubaneswar shall be the nodal agency and all correspondence with respect to this work including periodic reports and raising of invoice shall be done by the nodal

agency only. The payment and other issues of IOP and IIT, BBS as per Ann-I are to be settled by IMMT through separate work order/ MoU, with intimation to NALCO.

6. Project Cost:

The cost of the project is **Rs 49.85 lakhs** (Rupees Forty Nine Lakh Sixty Eighty Five Thousand only) excluding GST as per the break up given below (indicative only). The detailed breakup of the project cost amongst the collaborative institutes has been provided in the **Annexure -I** attached with this work order.

| Sl. No. | Item | Cost (In Rs) |
|---------|--|------------------|
| 1 | Equipment and Machinery support, Raw materials | 5,00,000 |
| 2 | Experiments, Testing and Documentation | 4,50,000 |
| 3 | Manpower - Research Fellow, Project Asst/ Research Professionals etc (outsourcing) | 28,00,000 |
| 3 | Conveyance, tours and travels | 2,50,000 |
| 4 | Miscellaneous and Contingency | 3,00,000 |
| 5 | Institute Overheads | 6,85,000 |
| | Total | 49,85,000 |

*Administrative overhead include utilities, establishment etc.

7. Payment Terms:

Payment to be released against GST compliant Invoice. NALCO GSTIN is 21AAACN7449M1Z9. Payment schedule is as given below.

| | |
|--|-----|
| On signing and acceptance of Work order along with submission of activity schedule for the project. | 30% |
| After completion of development of materials & optimization of the process with submission of 1 st interim report | 30% |
| After completion of fabrication of coin cell type superconductor along with draft final report. | 30% |
| On submission of final report and upon acceptance of final report by NALCO. | 10% |

8. Duration of the project: 24 (Twenty Four) months from zero date.

9. Zero date of the Project Execution:

Zero date of the project will be the date of release of 1st installment of the project money by NALCO.

10. Taxes & Duties:

Tax at the prevailing rate is to be paid by NALCO extra. Applicable Income Tax @ prevailing rate will be deducted at source.

- i. For the purpose of this Special Condition of Contract (SCC), the term "tax" in addition to tax imposed under CGST (Central Tax)/SGST (State Tax)/IGST (Integrated Tax)/UTGST (Union

Territory Tax)/ GST Compensation Cess Acts, also includes any duties, cess or statutory levies levied by central or state authorities.

- ii. Rate variation in Taxes and any new promulgated taxes after last date of the submission of price bid only on the goods and/or services applicable to invoices raised on NALCO within the contractual delivery date /period (including extension approved if any) shall be on NALCO's Account against submission of documentary evidence.
- iii. Further , in case of delay in delivery of goods and/or services, any upward rate variation in Taxes and any new promulgated taxes imposed after the contractual delivery date shall be to the M/s IMMT, Bhubaneswar's Account.
- iv. It would be the responsibility of the M/s IMMT, Bhubaneswar to get the registration with the respective Tax authorities under provision of GST. Any taxes being charged by the M/s IIT, Bhubaneswar's would be claimed by issuing proper TAX Invoice in a GSTN (Goods & Services Tax Network) acceptable format indicating details elements of all taxes charged and necessary requirements as prescribed under the respective tax laws and also to mention his correct and valid GSTN number along with NALCO's GSTN number as applicable for particular supply on all invoices raised on NALCO under GST Regime.
- v. M/s IMMT, Bhubaneswar would be liable to reimburse or make good of any loss/claim by NALCO towards tax credit rejected /disallowed by any tax authorities due to non-deposit of taxes or non-updating of the data in GSTIN network or non-filing of returns or noncompliance of tax laws by the M/s IIT, Bhubaneswar by issuance of suitable credit note to NALCO. In case, M/s IMMT, Bhubaneswar does not issues credit note to NALCO, NALCO would be constrained to recover the amount including interest payable along with Statutory levy/Tax, if any, payable on such recovery.
- vi. Tax element on any Debit Note / Supplementary invoice, raised by the M/s IMMT, Bhubaneswar will be reimbursed by NALCO as long as the same is within the permissible time limit as per the respective taxation laws and also permissible under the Contract terms and conditions. M/s IMMT, Bhubaneswar to ensure that such debit Notes are uploaded while filing the statutory returns as may be prescribed from time to time.
- vii. M/s IMMT, Bhubaneswar will be under obligation for quoting/charging correct rate of tax as prescribed under the respective Tax Laws. Further the M/s IMMT, Bhubaneswar shall avail and pass on benefits of all exemptions/concessions/benefits/waiver or any other benefits of similar nature or kind available under the Tax Laws. In no case, differential Tax Claims due to wrong classification of goods and/or services or understanding of law or rules or regulations or any other reasons of similar nature shall be entertained by NALCO.
- viii. In case, NALCO's Input Tax Credit (ITC) is rejected on account of wrong levy of tax i.e. payment of Integrated Tax in place of Central Tax+ State/Union Territory Tax or vice versa, the M/s IMMT, Bhubaneswar is liable to make good the loss suffered by NALCO by issuance of suitable credit note to NALCO. In case, M/s IMMT, Bhubaneswar does not issue credit note to NALCO, NALCO would be constrained to recover the amount including interest payable along with Statutory levy, if any, payable on such recovery.
- ix. NALCO shall reimburse GST levied as per invoice issued by the M/s IMMT, Bhubaneswar as prescribed under section 31 of the CGST Act and respective states and Rules.

- x. To enable NALCO to avail ITC, the M/s IMMT, Bhubaneswar/supplier shall furnish/submit any and all certificates, documents and declarations as are required by NALCO to avail of the ITC with respect to GST reimbursed by NALCO on materials sold to NALCO.
- xi. The HSN Code under which the goods/service will fall should be clearly mentioned along with the Rate at the time of submission of invoice for releasing payment.
- xii. In case, NALCO is not able to take Input Tax Credit due to any noncompliance/default/negligence of the seller, the same shall be recovered from the pending bills/dues (including security deposit, BG etc.).
- xiii. Seller shall be responsible to indemnify NALCO for any loss, direct or implied, accrued to NALCO on account of supplier's failure to discharge his statutory liabilities like paying taxes on time, filling appropriate returns within the prescribed time etc.
- xiv. Any benefit by way of reduction in rate of tax or increase in input tax credit arising due to introduction of GST shall be passed on to NALCO through reduction in supply value by way of commensurate reduction in Bill value.

11. Obligation of NALCO:

Material required by IMMT, Bhubaneswar for the study shall be provided by NALCO from its Smelter Plant at Angul & Alumina refinery at Damanjodi as free issue. The free issue material is as per the following specification.

| Sl.No. | Material required | Quantity required | Specification of Material required |
|--------|-------------------|-------------------|------------------------------------|
| 1 | Aluminium | 5 kg | Wire Rod with at least 99% purity |
| 2 | Alumina | 5 kg | With at least 98.5% purity |

12. Obligation of IMMT, Bhubaneswar:

- i. To complete the work as per schedule and within the stipulated time frame, in close association with NALCO's R&D personnel and pass on all findings to NALCO regularly through Monthly Progress Report which may include photographs, videos of the experimental project work on or before 25th of every month.
- ii. Investigative efforts are not to be limited to the scope of work & methodology as brought out under the activities to be undertaken. IMMT, Bhubaneswar may adopt all the relevant techniques available at IMMT, Bhubaneswar to achieve the overall objective of the project.
- iii. IMMT, Bhubaneswar shall maintain complete and total confidentiality about all the information, results, findings, processes etc. of the project and shall not reveal, divulge or publish any part or all information without express written consent of NALCO.
- iv. IMMT, Bhubaneswar shall perform the project as per the scope & methodology outlined in this proposal.
- v. IMMT, Bhubaneswar shall demonstrate at least one batch (experiment), the findings of investigations concerning the project to NALCO.
- vi. In case, the findings of above demonstration test is not as per mutually agreed results as specified in the Project Proposal, IMMT, Bhubaneswar will arrange another batch demonstration test to establish the findings without any additional financial implication to NALCO.

- vii. However, in case, the results of the 2nd batch of demonstration test are also unsatisfactory, IMMT, Bhubaneswar will discuss with NALCO to settle the matter amicably.
- viii. On submission of draft final report and before submission of the final report a presentation on the project findings to be arranged by IMMT at NALCO.
- ix. On completion of detailed investigation, Draft Final Reports shall be submitted by IMMT, Bhubaneswar to NALCO for further action. IMMT, Bhubaneswar will prepare the Final Report after inclusion of NALCO's comments on the Draft Report, if any, and submit **4 copies** of the Final Report for NALCO's acceptance and necessary records and use in the company.
- x. IMMT, Bhubaneswar shall assist NALCO in commercialization of the Process Know-how developed under the project.
- xi. If there is a decision on patent filing to be done by NALCO, detail technical documentation required for patent filing is to be drafted by IMMT and submitted to NALCO for patent filing.
- xii. Utilization certificate shall be submitted to NALCO pertaining to the payment released by NALCO.
- xiii. Sample collection, Packing, Loading, Transportation and un-loading of all samples or any other requirements to be arranged and borne by IMMT, Bhubaneswar.
- xiv. IMMT shall make their own arrangements including travel, boarding and lodging for their visit to NALCO plant or corporate office for project related work.
- xv. IMMT, Bhubaneswar will evaluate the analytical accuracy of the test conducted by IOP, Bhubaneswar & IIT, Bhubaneswar and shall be responsible for the analytical accuracy.

13. Deliverables:

In proposed work the following are the deliverables expected.

- Development of Al-based materials for supercapacitor application (~500 F/g, ~1.5 V).
- Fabrication of Coin cell type supercapacitor (Prototype).
- Validation of the supercapacitor with characterization data.
- Monthly progress reports on 25th of every month.
- Final report containing all technical details e.g process details, findings, observations, material characterization reports, final recommendations & any relevant documents.
- A demonstration of the developed Al based coin cell supercapacitor has to be given to NALCO. The demonstration shall include comparison of the properties of the developed Al based supercapacitor with a conventional supercapacitor.
- IPR documents.

14. Confidentiality:

- i. During the tenure of this Work Order IMMT, Bhubaneswar and NALCO undertake on their behalf and on behalf of their Sub-contractors/employees/representatives/ associates/successors to maintain strict confidentiality pertaining to the Scope of Work under this Work Order for any purposes other than in any accordance with this Work Order.
- ii. IMMT, Bhubaneswar shall not disclose the know-how and/or process developed under this Work Order to any third party or person for a period of 10 years from the date of commencement of Work Order without prior written permission from NALCO.

15. Termination:

- i. Notwithstanding the provisions of the Work Order, this Work Order may be terminated by either party in the event that the other party has committed any breach of any material provision herein contained and failed to rectify such breach within 60 days after affected party

has given a written notice of such breach and of the possibility of termination of the Work Order by reason thereof.

- ii. If the Government of India or any statutory authority empowered to do so, decides/directs to terminate the Work Order, both parties will immediately discuss and agree for the liabilities and obligation of each party arising from such termination.
- iii. NALCO shall have the right to terminate the Work Order by giving 60 days notice without assigning any reasons therefore.

16. Effect of Termination:

Termination of the Work Order shall not affect;

- i. NALCO's obligation to make payments which have become due prior to the termination of the Work Order, after adjustments of all dues as per the Work Order.
- ii. All works done by IMMT, Bhubaneswar under the scope of the project or till the date of termination shall become the property of NALCO and IMMT, Bhubaneswar shall be bound to hand over all the documents and materials to NALCO before claiming any payment as per (i) above and NALCO reserves its rights to utilize the same for further development and research works and also reserves rights to utilize the services of any other agencies for the same.

17. Force Majeure:

Neither IMMT, Bhubaneswar nor NALCO shall be considered in default in performance of their obligations, if such performance is prevented or delayed because of war, hostilities, revolutions, civil commotion, strike, lockout, epidemic, fire, wind/storm, flood, earthquake, because of any law and order proclamation, regulation or ordinance of any Government or because of any Act of God or for any other cause beyond the reasonable control of the party affected, provided notice of any such cause with necessary evidence by which the obligation under this Work Order is thereby affected or prevented or delayed is given within 14 days from the happening of the event, and in case it is not possible to serve notice within the said 14 days period then within the shortest possible period without delay.

As soon as the cause of Force Majeure has been removed, the party whose ability to perform its obligations have been affected shall notify the other of such cessation and inform the other party of such notice of the actual delay incurred in such affected activity. An event which is Force Majeure wheresoever's it occurs, provided that it prevents, affects or delays the parties in performing contractual obligations, will justify the affected party's claim of Force Majeure. Should one or both parties be prevented from fulfilling contractual obligations by a state of Force Majeure lasting a continuous period of six months, either party has the right to terminate the Work Order. However, prior to deciding on termination, the parties shall consult each other and decide regarding the future performance of the Work Order.

18. Arbitration:

In case of any dispute or difference arising out of the work order, which cannot be resolved mutually between the parties, it shall be referred to a sole Arbitrator to be appointed by the CMD, NALCO. The CMD, NALCO shall communicate/ cause to communicate, a panel of three names of persons to IMMT, Bhubaneswar in this regard within 30 (thirty) days of

receipt of notice of arbitration from IMMT, Bhubaneswar to select anyone of them to be appointed as the Arbitrator. In case IMMT, Bhubaneswar has not communicated its selection as above within thirty days of receipt of communication from NALCO, CMD (NALCO) will appoint any one of them as the Sole Arbitrator. During the Arbitral proceedings the fees and expenses fixed by the Arbitral tribunal shall be deposited in equal shares by both the parties which will be subject to the final award as to costs and as to the liabilities for costs in the award. However, in the arbitral proceeding if either party fails to deposit its share of the fees and expenses or deposit the said party will not be entitled to participate in the arbitration proceeding. The Arbitrator shall give a reasoned and speaking award. The award of the Arbitrator shall be binding on both the parties. The venue of arbitration shall be at Bhubaneswar. In case of any vacancy another Arbitrator will be appointed in the same manner as above. The Arbitration and conciliation Act 1996 as amended by the Arbitration and Conciliation (Amendment) Act, 2015 or any statutory modification or re-enactment thereof and the rules made there shall be applicable to this agreement.

19. Jurisdiction:

This Work Order shall be governed and construed in accordance with the laws applicable in India subject to exclusive jurisdiction of Courts of Bhubaneswar (Odisha) only.

20. First Use Right:

NALCO will have the "First Right" to use the technology/know-how/knowledge developed under the present Joint Research Project (JRP). After commercialization by NALCO, the sharing of revenue out of the project is to be decided mutually through separate terms & condition or agreement.

21. Third Party Licensing:

NALCO shall make all efforts to commercialize the process developed in this project. For this purpose, a separate agreement shall be signed between IMMT, Bhubaneswar and NALCO, if required.

Intellectual Property generated out of this collaborative R&D may be licensed / marketed by IMMT, Bhubaneswar to third party only after taking permission from NALCO on a mutually agreed terms and condition.

22. Intellectual Property Protection:

Any Intellectual Property Rights (Patents/Design/Trade Mark/Copy Right) obtained by the Parties hereto pertaining to collaborative R&D prior to signing of the agreement shall remain the property of that Party. The other Party shall have the right to commercially exploit/use the Intellectual Property on mutually agreed terms.

IMMT, Bhubaneswar, NALCO and collaborating agencies of IMMT, Bhubaneswar shall endeavor to protect the Intellectual property of the know-how/process by filing patents/publishing research outputs etc. The associated Scientists, Engineers and Technologists of the organizations will be named as the true and first Inventors of the process know-how.

The successful outcome of the project efforts with respect to development of process technology, if found suitable for filing of patent(s), then in such a case the patent has to be filed by IMMT, Bhubaneswar in the name of NALCO & IMMT, Bhubaneswar as the applicant.

with names of all associated investigators from all the collaborating agencies including NALCO. The Patenting expenditure will be equally shared by NALCO & IMMT, Bhubaneswar.

23. Other Conditions:

- i. In case, NALCO decides to use either fully or in part the results, findings, processes etc. of this project for its own use, NALCO shall not be obliged to pay any fees, royalties or any more payment to IMMT, Bhubaneswar. However IMMT, Bhubaneswar will not use either fully or partly the know-how/ process developed without permission of NALCO.
- ii. In case of any reason whatsoever, IMMT, Bhubaneswar fails to initiate the research activities at all within a period of two months of acceptance of this Work Order, the entire fund should be refunded by IMMT, Bhubaneswar to NALCO without any prejudice. In case the research work stops permanently for any reason, the unspent amount should be refunded by IMMT, Bhubaneswar to NALCO.
- iii. The Scientists/ Engineers both from NALCO and IMMT, Bhubaneswar will jointly review the progress half yearly either at NALCO or at IMMT, Bhubaneswar or by communication. On termination of the Project, no further payment will be made to IMMT, Bhubaneswar for the balance period and IMMT, Bhubaneswar to submit Fund Utilization Certificate for funds released till the date of termination.
- iv. All communications concerning the project activities may be addressed to GM (R&D), Corporate Office, NALCO Bhawan, P-1, Nayapalli, Bhubaneswar-751013.

24. Confirmation of Work Order:

We are forwarding herewith the Work Order in duplicate. One copy is to be returned duly signed, stamped and dated, to as under, as token of your acceptance, within 10 days of receipt of this Work Order.

Thanking you,

Yours faithfully,

For & on behalf of National Aluminium Company Limited

Subrat Kar
14/9
(Subrat Kar)

General Manager (R&D)

We accept the Work Order and its entire content

For & on behalf of IMMT, Bhubaneswar

Signature and Seal

Witness Name & Address:

1.

प्रधान, आर.डी.पी.डी. / Head R & D Planning
सीएसआईआर-खनिज एवं पदार्थ प्रौद्योगिकी संस्थान
CSIR-Institute of Minerals & Materials Technology
भुवनेश्वर, ओडिशा, (भारत)
Bhubaneswar-751013, Odisha (India)

2.

Dr. Pankaj Kumar Jena
Senior Scientist
CSIR-IMMT

ANNEXURE - I

| Sl. No. | Item | Amount (in Rs.) IMMT, Bbsr | Amount (In Rs.) IIT, Bbsr | Amount (In Rs.) IOP, Bbsr | Total |
|---------|--|-------------------------------|------------------------------|------------------------------|------------------|
| 1 | Equipment and Machinery support, Raw materials | 4,00,000 | Nil | 1,00,000 | 5,00,000 |
| 2 | Experiments, Testing and Documentation | 3,00,000 | 50,000 | 1,00,000 | 4,50,000 |
| 3 | Manpower - Research Fellow, Project Asst/ Research Professionals etc (outsourcing) | 16,00,000 | 6,00,000 | 6,00,000 | 28,00,000 |
| 3 | Conveyance, tours and travels | 1,50,000 | 50,000 | 50,000 | 2,00,000 |
| 4 | Miscellaneous and Contingency | 2,00,000 | 50,000 | 50,000 | 3,00,000 |
| 5 | Institute Overheads | 4,00,000 | 1,50,000 | 1,35,000 | 6,85,000 |
| | Total | | | | 49,85,000 |

s. Gh

2

WORK ORDER

Ref No: NBC/R&D/68/01/1224

Date: 20-09-2018

To,

The Director,
Institute of Physics,
Bhubaneswar- 751013.

Sub: Work Order on "High pure Nano-Alumina for solar cell anti- reflection coatings and reinforcing aluminium"

Ref: Your project proposal submitted to NALCO dated 09-11-2017

Dear Sir,

With reference to the subject of project proposal submitted to NALCO and subsequent clarification, we are pleased to issue this Work Order in accordance with agreed terms and conditions as set out below.

The work order incorporating the complete technical specifications and other conditions, which also forms part of this work order, no variation of any nature shall be permitted to those conditions of this work order except with the prior written consent of NALCO.

Whereas Institute of Physics (herein after called IOP). Bhubaneswar along with its collaborative agencies IMMT, Bhubaneswar and IIT Bhubaneswar have agreed for undertaking a Collaborative R&D Project on "*High pure Nano-Alumina for solar cell anti-reflection coatings and reinforcing aluminium*". However, IOP, Bhubaneswar shall be nodal agency and responsible for implementation of this project as per the terms and condition of this work order. All correspondences, including payments shall be done with IOP, Bhubaneswar.

1. Project Title:

High pure Nano-Alumina for solar cell anti- reflection coatings and reinforcing aluminium.

2. Objective: To develop High pure Nano-Alumina for use in solar cell anti- reflection coatings and reinforcing aluminium

3. Scope of work:

- i. To develop new technologies for industrially adaptable and cost effective production of high purity alumina (HPA) nano-powder films using laser ablation and chemical routes.
- ii. Use of the nano-HPA powder films as antireflection coatings in Solar Cells and other glasses.

4

नेशनल एल्युमिनियम कम्पनी लिमिटेड
(भारत सरकार का उद्यम)
निगम कार्यालय
नालको भवन, नयापल्ली, भुवनेश्वर-751 061, भारत

Page 1 of 8
National Aluminium Company Limited
(A Government of India Enterprise)
CORPORATE OFFICE
NALCO BHAVAN, Nayapalli, Bhubaneswar-751 061, INDIA

फोन Phone: (EPABX) (0674) 2301988, 2301999, 2300013, 2300976, 2301550, 2303233
फैक्स Fax: (0674) 2301290, 2300580, 2300740, 2300640 & 2300246
वेबसाइट Website: www.nalcoindia.com

4. Methodology:

- i) Laser Ablation technique for preparation of HPA nano-powder thin films:
 - a. The laser will interact with the Aluminium kept in DI water / vacuum / ambient / ethanol solution and evaporation or plasma formation will occur.
 - b. Evaporated particles will collide with other and form the powder.
 - c. The size of the particles will be controlled by using different laser energies.
- ii) Using Aluminium Scrap using Oxidation and regulated furnace annealing to make HPA.
 - a. Oxidation of scrap In KOH solution around 300°C.
 - b. Heated in Muffle furnace at 1100°C to form Al(OH)₃
 - c. Vacuum Annealing at 1750°C to produce Al₂O₃ by this high purity α - Al₂O₃ can obtain
- iii) Characterisation: Various techniques; X-ray diffraction, scanning electron microscopy (SEM), tunnelling electron microscopy (TEM), Mass spectroscopy and anti-reflection and thermal conductivity measurements.

5. Project Cost:

Rs 49, 87,500/- (Rupees is forty nine lakh eighty seven thousand five hundred rupees only) is required to carry out the project excluding GST. The indicative cost break-up is given below.

| Activities | Amount, Rs-Lakh- |
|---|--------------------|
| Equipment and Machinery support, Raw materials | 6.0 |
| Experiments, Testing and Documentation | 4.0 |
| Manpower- Research Fellow, Project Asst/ Research Professionals etc.(outsourcing) | 23.6 |
| Conveyance, tours and travels | 4.4 |
| Misc and Contingency | 5.0 |
| Institute Overheads | 6.875 |
| Total | 49.875 +GST |

6. Payment Terms:

Payment on submission of invoice in compliance to GST rule indicating NALCO GSTN: 21AAACN7449MIZ9 shall be released in phases as given below.

| Sl No | Payment Schedule | % of Payment |
|-------|--|--------------|
| 1 | On signing and acceptance of work order and submission of endorsement letter from collaborative Institute/Agency along with activity schedule of the project | 40 |
| 2 | After completion of one year and submission of report | 30 |
| 3 | On submission of final report and upon acceptance of the same by NALCO | 30 |

7. **Duration of the project:** Twenty four (24) months from zero date.

8. **Zero date of the project:** Zero date of the project will be the date of release of 1st instalment of the project money by NALCO.

9. Taxes and Duties:

Tax at the prevailing rate is to be paid by NALCO extra. Applicable Income Tax @ prevailing rate will be deducted at source.

- i) For the purpose of this Special Condition of Contract (SCC), the term "tax" in addition to tax imposed under CGST (Central Tax)/SGST (State Tax)/IGST (Integrated Tax)/UTGST (Union Territory Tax)/ GST Compensation Cess Acts, also includes any duties, cess or statutory levies levied by central or state authorities.
- ii) Rate variation in Taxes and any new promulgated taxes after last date of the submission of price bid only on the goods and/or services applicable to invoices raised on NALCO within the contractual delivery date /period (including extension approved if any) shall be on NALCO's Account against submission of documentary evidence.
- iii) Further, in case of delay in delivery of goods and/or services, any upward rate variation in Taxes and any new promulgated taxes imposed after the contractual delivery date shall be to the M/s IOP's Account.
- iv) It would be the responsibility of the M/s IOP to get the registration with the respective Tax authorities under provision of GST. Any taxes being charged by the M/s IOPs would be claimed by issuing proper TAX Invoice in a GSTN (Goods & Services Tax Network) acceptable format indicating details elements of all taxes charged and necessary requirements as prescribed under the respective tax laws and also to mention his correct and valid GSTN number along with NALCO's GSTN number as applicable for particular supply on all invoices raised on NALCO under GST Regime.
- v) M/s IOP would be liable to reimburse or make good of any loss/claim by NALCO towards tax credit rejected /disallowed by any tax authorities due to non-deposit of taxes or non updation of the data in GSTIN network or non-filing of returns or non-compliance of tax laws by the M/s IOP by issuance of suitable credit note to NALCO. In case, M/s IOP does not issues credit note to NALCO, NALCO would be constrained to recover the amount including interest payable along with Statutory levy/Tax, if any, payable on such recovery.
- vi) Tax element on any Debit Note / Supplementary invoice, raised by the M/s IOP will be reimbursed by NALCO as long as the same is within the permissible time limit as per the respective taxation laws and also permissible under the Contract terms and conditions. M/s IOP's to ensure that such debit Notes are uploaded while filing the statutory returns as may be prescribed from time to time.
- vii) M/s IOP will be under obligation for quoting/charging correct rate of tax as prescribed under the respective Tax Laws. Further the M/s IOP shall avail and pass on benefits of all exemptions/concessions/benefits/waiver or any other benefits of similar nature or kind available under the Tax Laws. In no case, differential Tax Claims due to wrong classification of goods and/or services or understanding of law or rules or regulations or any other reasons of similar nature shall be entertained by NALCO.
- viii) In case, NALCO's Input Tax Credit (ITC) is rejected on account of wrong levy of tax i.e. payment of Integrated Tax in place of Central Tax+ State/Union Territory Tax or vice versa, the M/s IOP is liable to make good the loss suffered by NALCO by issuance of suitable credit note to NALCO. In case, M/s IOP does not issue credit note

- to NALCO, NALCO would be constrained to recover the amount including interest payable along with Statutory levy, if any, payable on such recovery.
- ix) NALCO shall reimburse GST levied as per invoice issued by the M/s IOP as prescribed under section 31 of the CGST Act and respective states and Rules.
 - x) To enable NALCO to avail ITC, the M/s IOP/supplier shall furnish/submit any and all certificates, documents and declarations as are required by NALCO to avail of the ITC with respect to GST reimbursed by NALCO on materials sold to NALCO.
 - xi) The HSN Code under which the goods/service will fall should be clearly mentioned along with the Rate at the time of submission of invoice for releasing payment.
 - xii) In case, NALCO is not able to take Input Tax Credit due to any noncompliance/default/negligence of the seller, the same shall be recovered from the pending bills/dues (including security deposit, BG etc.).
 - xiii) Seller shall be responsible to indemnify NALCO for any loss, direct or implied, accrued to NALCO on account of supplier's failure to discharge his statutory liabilities like paying taxes on time, filling appropriate returns within the prescribed time etc.
 - xiv) Any benefit by way of reduction in rate of tax or increase in input tax credit arising due to introduction of GST shall be passed on to NALCO through reduction in supply value by way of commensurate reduction in Bill value.

10. Obligation of NALCO: NALCO shall provide required samples of Aluminium and Alumina available with Nalco free of cost to IOP for the project work.

11. Obligation of IOP, Bhubaneswar:

- i) To complete the work as per schedule and within the stipulated time frame. IOP, Bhubaneswar, has to work in close association with NALCO's R&D personnel and pass on all information and findings to NALCO regularly by Monthly Progress Report which may include photographs / videos of the experimental / project work in the last week of every month i.e. before 25th of each month.
- ii) Investigative efforts will not be limited to the scope of work as brought out under the activities to be undertaken at IOP, Bhubaneswar but by adopting all techniques available at IOP, Bhubaneswar to achieve the overall objective of the project.
- iii) IOP, Bhubaneswar shall maintain complete and total confidentiality about all the Information, results, findings, processes etc. in the project and shall not reveal, divulge or publish, any or all information without express written consent of NALCO.
- iv) IOP, Bhubaneswar has to perform the project as per the objective, scope & methodology outlined in this proposal.
- v) IOP, Bhubaneswar has to demonstrate at least one batch (experiment), the findings of investigations concerning the project to NALCO's R&D personnel. In case, the findings of above demonstration test is not as per mutually agreed results as specified in the Project Proposal, IOP, Bhubaneswar will arrange another batch demonstration test to establish the findings without any additional financial claim to NALCO. However, in case, the results of the 2nd batch of demonstration test are also unsatisfactory, IOP, Bhubaneswar will discuss with NALCO to settle the matter amicably.

- vi) On completion of detailed investigation, Draft Final Reports shall be submitted by IOP, Bhubaneswar to NALCO at least two months before of schedule date of completion. NALCO will give comment within one month of receipt of the draft final report. IOP, Bhubaneswar will prepare the Final Report after inclusion of NALCO's comments on the Draft Report, if any, and submit 4 copies of the Final Report for NALCO's acceptance and necessary records and use in the company.
- vii) Utilization certificate to be submitted to NALCO.
- viii) Sample collection, Packing, Loading, Transportation and un-loading of all samples or any other requirements to be arranged and borne by IOP, Bhubaneswar.
- ix) IOP shall make their own arrangements including travel, boarding and lodging for their visit to NALCO for the project work.

12. Deliverables:

- i) High pure alumina powders (target purity 99.99%) are expected: technologies would be developed Al as source materials.
- ii) Application for anti-reflection coating would be established.
- iii) Coating for screens would be developed.
- iv) Validate with scientific backups and derive optimum process and conditions at laboratory scale
- v) IPR and Publications with Report.

13. Confidentiality:

- i) During the tenure of this Work Order IOP, Bhubaneswar and NALCO undertake on their behalf and on behalf of their Sub-contractors/employees/representatives/associates/successors to maintain strict confidentiality pertaining to the Scope of Work under this Work Order for any purposes other than in any accordance with this Work Order.
- ii) IOP, Bhubaneswar shall not disclose the test results/ know-how and/or process developed under this Work Order to any third party or person for a period of 10 years from the date of commencement of Work Order without prior written permission from NALCO.
- iii) Similarly NALCO shall not disclose the test results/ know-how and/or process developed under this Work Order to any third party or person for a period of 10 years from the date of commencement of Work Order without prior written permission from IOP.

14. Termination:

- i) Notwithstanding the provisions of the Work Order, this Work Order may be terminated by either party in the event that the other party has committed any breach of any material provision herein contained and failed to rectify such breach within 60 days after affected party has given a written notice of such breach and of the possibility of termination of the Work Order by reason thereof.
- ii) If the Government of India or any statutory authority empowered to do so, decides/directs to terminate the Work Order, both parties will immediately discuss and agree for the liabilities and obligation of each party arising from such termination.

- iii) NALCO shall have the right to terminate the Work Order by giving 60 days' notice without assigning any reasons therefore.

15. Effect of Termination:

Termination of the Work Order shall not affect;

- i) NALCO's obligation to make payments which have become due prior to the termination of the Work Order, after all due adjustments.
- ii) All works done by IOP, Bhubaneswar under the scope of the project till the date of termination shall become the property of NALCO and IOP, Bhubaneswar shall be bound to hand over all the documents and materials to NALCO before claiming any payment as per (i) above and NALCO reserves its rights to utilize the same for development and research works and also reserves rights to utilize the services of any other agencies for the same.

16. Force Majeure:

Neither IOP, Bhubaneswar nor NALCO shall be considered in default in performance of their obligations, if such performance is prevented or delayed because of war, hostilities, revolutions, civil commotion, strike, lockout, epidemic, fire, wind/storm, flood, earthquake, because of any law and order proclamation, regulation or ordinance of any Government or because of any Act of God, or for any other cause beyond the reasonable control of the party affected, provided notice of any such cause with necessary evidence by which the obligation under this Work Order is thereby affected or prevented or delayed is given within 14 days from the happening of the event, and in case it is not possible to serve notice within the said 14 days period then, within the shortest possible period without delay.

As soon as the cause of Force Majeure has been removed, the party whose ability to perform its obligations have been affected shall notify the other of such cessation and inform the other party of such notice of the actual delay incurred in such affected activity. An event which is Force Majeure wheresoever's it occurs, provided that it prevents, affects or delays the parties in performing contractual obligations, will justify the affected party's claim of Force Majeure. Should one or both parties be prevented from fulfilling contractual obligations by a state of Force Majeure lasting a continuous period of six months, either party has the right to terminate the Work Order. However, prior to deciding on termination, the parties shall consult each other and decide regarding the future performance of the Work Order.

17. Arbitration:

In case of any dispute or difference arising out of the work order, which cannot be resolved mutually between client and IOP, Bhubaneswar, it shall be referred to a sole Arbitrator to be appointed by the CMD, NALCO. The CMD, NALCO shall communicate/ cause to communicate, a panel of three names of persons to IOP, Bhubaneswar in this regard within 30 (thirty) days of notice of arbitration from IOP, Bhubaneswar to select anyone of them to be appointed as the Arbitrator. In case IOP, Bhubaneswar has not communicated its selection as above within thirty days of receipt of communication from NALCO, CMD, NALCO will appoint any one of them as the Sole Arbitrator. During the Arbitral proceedings the fees and expenses fixed by the Arbitral tribunal shall be deposited in equal

shares by both the parties which will be subject to the final award as to costs and as to the liabilities for costs in the award. However, in the arbitral proceeding if either party fails to deposit its share of the fees and expenses or deposit the said party will not be entitled to participate in the arbitration proceeding. The Arbitrator shall give a reasoned and speaking award. The award of the Arbitrator shall be binding on both the parties. The venue of arbitration shall be at Bhubaneswar. In case of any vacancy another Arbitrator will be appointed in the same manner as above. The Arbitration and conciliation Act 1996 as amended by the Arbitration and Conciliation (Amendment) Act, 2015 or any statutory modification or re-enactment thereof and the rules made there shall be applicable to this agreement.

18. Jurisdiction:

This Work Order shall be governed and construed in accordance with the laws applicable in India subject to exclusive jurisdiction of Courts of Bhubaneswar (Orissa) only.

19. First Use Right:

NALCO will have the "First Right" to use the technology/know-how/knowledge developed under the present Joint Research Project (JRP). After commercialization by NALCO, the sharing of revenue out of the project is to be decided mutually through separate terms & condition or agreement.

20. Third Party Licensing:

NALCO shall make all efforts to commercialize the process developed in this project. For this purpose, a separate agreement shall be signed between IOP, Bhubaneswar and NALCO, if required.

Intellectual Property generated out of this collaborative R&D may be licensed/ marketed by IOP, Bhubaneswar to third party only after taking permission from NALCO on a mutually agreed terms and condition.

21. Intellectual Property Protection:

Any Intellectual Property Rights (Patents/Design/Trade Mark/Copy Right) obtained by the Parties hereto pertaining to collaborative R&D prior to signing of the agreement shall remain the property of that Party. The other Party shall have the right to commercially exploit/use the Intellectual Property on mutually agreed terms.

IOP, Bhubaneswar, NALCO and collaborating agencies of IOP, Bhubaneswar shall endeavour to protect the Intellectual property of the know-how/process by filing patents/publishing research outputs etc. The associated Scientists, Engineers and Technologists of the organizations will be named as the true and first inventors of the process know-how.

The successful outcome of the project efforts with respect to development of process technology, if found suitable for filing of patent(s), then in such a case the patent has to be filed by IOP in the name of NALCO & IOP, Bhubaneswar as the applicant, with names of all associated investigators from all the collaborating agencies. The Patenting expenditure will be equally shared by NALCO & IOP, Bhubaneswar.

22. Other Conditions:

- i) In case, NALCO decides to use either fully or in part the results, findings, processes etc. of this project for its own use, NALCO shall not be obliged to pay any fees, royalties or any more payment to IOP, Bhubaneswar. However IOP, Bhubaneswar will not use either fully or part the know-how/ process developed without permission of NALCO.
- ii) In case of any reason whatsoever, IOP, Bhubaneswar fails to initiate the research activities at all within a period of two months of acceptance of this WO, the entire fund should be refunded by IOP, Bhubaneswar to NALCO without any prejudice. In case the research work stops permanently for any reason, the unspent amount should be refunded by IOP, Bhubaneswar to NALCO.
- iii) The Scientists/ Engineers both from NALCO and IOP, Bhubaneswar will jointly review the progress half yearly either at NALCO or at IOP, Bhubaneswar or by communication. On termination of the Project, no further payment will be made to IOP, Bhubaneswar for the balance period and IOP, Bhubaneswar to submit Fund Utilization Certificate for funds released so far.
- iv) All communications concerning the project activities may be addressed to the concerned executive, in this project to GM(R&D), Corporate Office at NALCO Bhavan ,P-1, Nayapali, Bhubaneswar-751013.

23. Confirmation of Work Order:

We are forwarding herewith the Work Order in duplicate. One copy is to be returned duly signed, stamped and dated, to as under, in token of your acceptance, within 10 days of receipt of this Work Order.

Thanking you,

Yours faithfully,
For & on behalf of National Aluminium Company Limited

Subrat Kar
20/09/18
(Subrat Kar)
General Manager (R&D)

We accept the Work Order and its entire content
For & on behalf of IOP, Bhubaneswar.

Rishi Kumar Naha

Signature and Seal

Witness Name & Address:

रेजिस्ट्रार/REGISTRAR
भौतिकी संस्थान/INSTITUTE OF PHYSICS
भुवनेश्वर/BHUBANESWAR